International Journal of Computer and Information Sciences publishes (1) high-quality, definitive, original les that have been appropriately reviewed by competent scientific workers, (2) reviews of recent developts in the field, and (3) tutorial and expository papers covering specific areas of interest and applications of puter and information sciences. The journal aims to provide a forum for research workers and students in field and to expedite communication between them and other scientists interested in applications. We me that the journal will be read by those with a common interest in computer and information sciences but diverse backgrounds, such as engineering, mathematics, statistics, physics, chemistry, management science, ry science, biomedical science, and behavioral science. Emphasis is placed upon both theoretical and rimental work that is of deep conceptual significance. The scope of the journal includes: software neering; systems programming; pattern recognition; picture processing; computer graphics; information eval; computer organization; language processing; automata theory; mathematical linguistics; computer rol; data structure and access; management information systems; biomedical information processing.

#### TOR-IN-CHIEF

s T. Tou

ctor, Center for Information Research, University of Florida, Gainesville, Florida

#### TORIAL BOARD

W. Backus, IBM Corporation, San Jose, ulifornia ert S. Barton, Burroughs Corporation, Paoli,

nnsylvania

nas E. Cheatham, Jr., Harvard University,

umbridge, Massachusetts
C. Chen, IBM Corporation, San Jose,

elifornia

old P. Edmundson, University of Maryland, ollege Park, Maryland

5. Fu, Purdue University, Lafayette, Indiana C. Gonzalez, University of Tennessee, Knox-

le, Tennessee
Grenarder, Brown University, Providence,

node Island

G. Ivakhnenko, Ukrainian Academy of ience, Kiev, USSR

d Kuck, University of Illinois, Urbana, inois

Lukaszewicz, Academy of Sciences, arsaw, Poland
e H. McCormick, University of Illinois.

nicago, Illinois

Robert McNaughton, Rensselaer Polytechnic Institute, Troy, New York Saburo Muroga, University of Illinois, Urbana,

Illinois

Injecti Naguma University of Tokyo Tokyo

Jin-ichi Nagumo, University of Tokyo, Tokyo, Japan

C. V. Ramamoorthy, University of California, Berkeley, California

J. C. Simon, Université de Paris, Paris, France V. K. Smirnov, Academy of Sciences, Moscow, USSR

Daniel Teichroew, University of Michigan, Ann Arbor, Michigan

W. M. Turski, Warsaw University, Warsaw, Poland

W. L. van der Poel, Technische Hogeschool, Delft, The Netherlands

Michael S. Watanabe, University of Hawaii Honolulu, Hawaii

Peter Wegner, Brown University, Providence, Rhode Island

Maurice V. Wilkes, University of Cambridge, Cambridge, England

ished bimonthly at Tempelhof 41, Bruges, Belgium, by Plenum Publishing Corporation, 233 Spring Street, York, N.Y. 10013. In 1984, Volume 13 (6 issues) will be published. Subscription orders should be essed to the publisher. International Journal of Computer and Information Sciences is abstracted or indexed pplied Mechanics Reviews; Chemical Abstracts; Chemical Titles; Computer and Information Systems racts Journal; Current Contents; Engineering Index; INSPEC—Computer and Control Abstract, Electrical Electronics Abstracts, and Electronics Abstracts; Management Contents; Mathematical Reviews; Referativ-Zhurnal; Science Citation Index; and Sociological Abstracts. © 1984 Plenum Publishing Corporation. Inational Journal of Computer and Information Sciences participates in the Copyright Clearance Center C) Transactional Reporting Service. The appearance of a code line at the bottom of the first page of an le in this journal indicates the copyright owner's consent that copies of the article may be made for performental use. However, this consent is given on the condition that the copier pay the flat fee of \$3.50 topy per article (no additional per-page fees) directly to the Copyright Clearance Center, Inc., 21 Congress t, Salem, Massachusetts 01970, for all copying not explicitly permitted by Sections 107 or 108 of the U.S. wright Law. The CCC is a nonprofit clearinghouse for the payment of photocopying fees by libraries and rusers registered with the CCC. Therefore, this consent does not extend to other kinds of copying, such as ing for general distribution, for advertising or promotional purposes, for creating new collective works, or esale, nor to the reprinting of figures, tables, and text excerpts. 0091-7036/84 \$3.50

cription rates

olume 13, 1984 (6 issues) \$195.00 (outside the U.S., \$218.00). olume 14, 1985 (6 issues) \$195.00 (outside the U.S., \$218.00).

nd-class postage paid at Jamaica, N.Y. 11431. Postmaster: Send address changes to *International Journal of puter and Information Sciences*, Plenum Publishing Corporation, 233 Spring Street, New York, N.Y. 10013. reight and mailing in the USA by Publications Expediting, Inc., 200 Meacham Avenue, Elmont, N.Y.

ed in Belgium.

Published bimonthly at Tempelhof 41, Bruges, Belgium, by Plenum Publishing Corporation, 233 Spring Street, New York, N.Y. 10013. In 1984, Volume 13 (6 issues) will be published. Subscription orders should be addressed to the publisher. International Journal of Computer and Information Sciences is abstracted or indexed in Applied Mechanics Reviews; Chemical Abstracts: Chemical Titles: Computer and Information Systems Abstracts Journal; Current Contents; Engineering Index; INSPEC-Computer and Control Abstract, Electrical and Electronics Abstracts, and Electronics Abstracts; Management Contents; Mathematical Referativnyi Zhurnal; Science Citation Index; and Sociological Abstracts. © 1984 Plenum Publishing Corporation. International Journal of Computer and Information Sciences participates in the Copyright Clearance Center (CCC) Transactional Reporting Service. The appearance of a code line at the bottom of the first page of an article in this journal indicates the copyright owner's consent that copies of the article may be made for personal or internal use. However, this consent is given on the condition that the copier pay the flat fee of \$3.50 per copy per article (no additional perpage fees) directly to the Copyright Clearance Center, Inc., 21 Congress Street, Salem, Massachusetts 01970, for all copying not explicitly permitted by Sections 107 or 108 of the U.S. Copyright Law. The CCC is a nonprofit clearinghouse for the payment of photocopying fees by libraries and other users registered with the CCC. Therefore, this consent does not extend to other kinds of copying, such as copying for general distribution, for advertising or promotional purposes, for creating new collective works, or for resale, nor to the reprinting of figures, tables, and text excerpts. 0091-7036/84 \$3.50

Vol. 13, No. 1

February 1984

Microcode Compaction: Extending the Boundaries  David Landskov, Joseph A. Fisher, and Bruce D. Shriver	1
An Optimal Time and Minimal Space Algorithm for Rectangle Intersection Problems D. T. Lee	23
Inferability of Context-Free Programmed Grammars  H. R. Lu and K. S. Fu	33
Algorithms for the Inverse and a Generalization of the State Space Approach to Finite Automata Chao-Chih Yang and Houkuan Huang	59

Vol. 13, No. 2 April 1984

Binary Search Trees with Binary Comparison Cost  Thomas Ottman, Arnold L. Rosenberg, Hans-Werner Six, and  Derick Wood	77
On the Method of Puzzles for Key Distribution Subhash C. Kak	103
Parallel Multipliers with NOR Gates Based on G-Minimum Adders  Ging-Shung Yu and Saburo Muroga	111
An Iterative Algorithm for the Cyclic Towers of Hanoi Problem M. C. Er	123

Vol. 13, No. 3 June 1984 CONTENTS On the Message Complexity of Distributed Problem Nicola Santoro Familial Model of Data 149 Levent Orman Inference of Tree Automata from Sample Set of Trees 177 H. Fukuda and K. Kamata Complexity, Convexity, and Unimodality 197 Godfried T. Toussaint A Glimpse into the Paradise of Combinatory Algebra 219

W. Richard Stark

Vol. 13, No. 4

August 1984

Frequency Decomposition Technique for Large Archivable Databases  Alex Kostovetsky	237
Parallel Solution of Recurrences on a Tree Machine  Roy P. Pargas	251
Checking Similarity of Planar Figures  Mikhail J. Atallah	279
CH Transform Kou Weidong and Hù Zheng	291
Further Remarks for the Matrix Type-B Codes D. C. Voukalis	309

Vol. 13, No. 5

October 1984

Embedding Deductive Capabilities in Relational Database Systems  Camilla B. Schwind	327
A Methodology for Designing and Modeling Reconfigurable Systems V. P. Srini and B. D. Shriver	339
Concatenated Hash Code Selection S. K. Chang and J. C. Dorng	395
A Grammatical Inference for Harmonic Linear Languages	413

Vol. 13, No. 6

December 198

Specification of Data Restructuring Software Based on the Attribute  Method  Timo Niemi	425
The Use of Hoare Logic in the Verification of Horizontal Micro programs Subrata Dasgupta and Alan Wagner	461
A VLSI Design for the Parallel Finite State Automaton and Its Performance Evaluation as a Hardware Scanner  A. R. Hurson	491
Surjections and Coverings  Lena Chang and Arthur T. Poe	509